4. $\underline{C_8H_8O_4}$ by the action of hydrochloric on hemipinic acid; thus,

$$C_{10}H_{30}O_6+HCl=C_8H_8O_4+C\,O_2+C\,H_3Cl.$$

5. $\underline{C_7H_6O_4}$ by the action of hydriodic acid on hemipinic acid; thus,

$$C_{10}H_{10}O_6+2H\,I=C_7H_6O_4+C\,O_2+2C\,H_3I.$$

In the second part of the paper the properties and the preparation of a new base prepared from narcotine are described. When narcotine is heated for from six to eight days with strong hydrochloric acid at 100°, two molecules of chloride of methyl are given off, and the chloride of the new base formed. The reaction which takes place is

$$C_{22}H_{23}N\,O_7+2HCl=C_{20}H_{19}N\,O_7+2C\,H_3Cl.$$

This base we have called *methyl-nor-narcotine*; it forms an almost white amorphous powder insoluble in water and ether, slightly soluble in alcohol; it is easily soluble in carbonate of sodium, by which means it may be separated from narcotine. None of its salts form crystalline compounds (the chloride, sulphate, and nitrate have been made). In the paper of which this is an abstract, mention is made of two other new bases derived from narcotine; these have not as yet been described. They are the dimethyl and nor-narcotines, the first being the product of the action of hydrochloric acid for a short time on narcotine, and the latter the product of the action of strong hydriodic acid on narcotine. The reactions may be written

$$C_{22}H_{23}N\,O_7+HCl=C_{21}H_{21}N\,O_7+CH_3Cl$$

and

$$C_{22}H_{23}N\,O_7+3H\,I=C_{19}H_{17}N\,O_7+3CH_3I.$$

There exist, therefore, four narcotines:—

1. Ordinary narcotine, or trimethyl nor-narcotine, $C_{22}H_{23}N\,O_7$.
2. ,, ,, dimethyl nor-narcotine, $C_{21}H_{21}N\,O_7$.
3. ,, ,, methyl nor-narcotine, $C_{20}H_{19}N\,O_7$.
4. ,, ,, nor-narcotine, $C_{19}H_{17}N\,O_7$.

The descriptions and properties of the first-mentioned new bases will form the subject of a future communication.

VIII. "On the Chemical Intensity of Total Daylight at Kew and Pará in 1865–67." By Henry E. Roscoe, F.R.S. Received May 14, 1867.

(Abstract.)

This communication contains the results of a regular series of measurements of the chemical action of daylight, carried out at the Kew Observatory, through the kindness of Dr. Balfour Stewart, according to the method described by the author in the Philosophical Transactions for 1864, p. 605. The observations extend over a period of two years, from April 1, 1865 to March 31, 1867. The second part of the communication gives the results of observations upon the Intensity of the Chemical action of Sunlight under the Equator, made at Pará in latitude 1° 28′ S. during the month of April 1866.

I. *Kew Observations.*

The Kew measurements do not profess to exhibit the changes in chemical intensity which occur from hour to hour, but they give, with accuracy, the mean monthly chemical intensity, showing the rise and fall with the changing seasons of the year, and they enable us to deduce the mean monthly and yearly chemical intensities at Kew for 1865–67.

Tables showing the daily mean chemical intensity obtained from the daily observations, according to the method described in the above-mentioned paper, are given. The first result which these observations yield is that the mean chemical intensity for hours equidistant from noon is constant; that is, the mean chemical intensities are equal for equal altitudes of the sun; thus the mean of all the observations made about $9^h\ 30^m$ A.M. corresponds with the mean intensity at $2^h\ 30^m$ P.M.

	Mean of Times of Observation.	Mean Chem. Intensity.
Mean of 529 Afternoon Observations in 1865–67.	........$9^h\ 41^m$	0·105
Mean of 552 Morning Observations in 1865–67.	........$2^h\ 27^m$	0·107.

Hence the author concludes that when the disturbing causes of variation in amount of cloud, &c. are fully eliminated by a sufficient number of observations, the daily maximum of chemical intensity corresponds to the maximum of sun's altitude. The author then shows from measurements made at varying altitudes of the sun at Heidelberg and Pará, that the relation between sun's altitude and chemical intensity may be represented by the equation

$$CI_a = CI_0 + \text{const.}\, a,$$

where CI_a represents the chemical intensity at a given altitude (a) in circular measure, CI_0 the chemical intensity at the altitude 0, and const. (a) a number to be calculated from the observations.

The agreement of the chemical intensities as found at Heidelberg with the calculated results is seen in the following Table:—

Altitude. ° ′	Chemical Intensity. Found.	Calculated.
7 15	0·050	0·050
24 43	0·200	0·196
34 34	0·306	0·276
53 37	0·437	0·435
62 30	0·518	0·506

A similar relation is found to hold good for the Pará observations. Assuming the same relation to exist at Kew as at Heidelberg and Pará, the values of the mean monthly intensity at noon have been calculated from the observations at 2.30 and 4.30 P.M., and the mean monthly integrals of chemical intensity for each month, from April 1865 to March

1867 inclusive, have been obtained. Curves exhibiting the daily rise and fall for each of the twenty-four months, as well as a curve showing the biennial variation of chemical intensity for the same period, accompany the paper. The curve of yearly chemical intensity is found to be unsymmetrical about the vernal and autumnal equinoxes; thus in spring and autumn the results are as follows:—

1865–67.	Mean Ch. Int.	1866.	Mean Ch. Int.
March 1867	30·5	March	34·5
April 1865	97·8	April	52·4
September 1865	107·8	September	70·1
August 1865	88·9	August	94·5

Or for 100 chemically active rays falling during the months of March and April 1865, 1866, and 1867 at Kew there fell in the corresponding autumnal months 167 rays, the sun's mean altitude being the same.

The author discusses the probable causes of this autumnal maximum; he finds that it is not due to variation in the amount of cloud, and believes that it is to be explained by a less amount of atmospheric opalescence in the autumn than in the spring.

The yearly integral for the twelve months, January to March 1867 and April to December 1865, is 55·7, whereas that for the twelve months of the year 1866 is 54·7.

II. *Pará Observations.*

All the knowledge we possess concerning the distribution and intensity of the chemically active rays in the tropics is derived from the vague statements of photographers. According to their observations it appears that the difficulty of obtaining a good photograph increases as we approach the equator; and more time is said to be needed to produce the same effect upon a sensitive plate under the full blaze of a tropical sun than is required in the gloomier atmosphere of London. Thus in Mexico, where the light is very intense, from twenty minutes to half an hour is stated to be required to produce photographic effects which in England occupy but a minute. Hence the existence of a peculiar retarding influence has been suggested which the heating and luminous rays are supposed to exert upon the more refrangible portions of the spectrum. The fallacy of these statements has been fully proved by a series of direct measurements of the chemical intensity of sunlight under the equator, made at Pará by Mr. T. E. Thorpe. The curves of daily chemical intensity given in the paper show that the activity of the chemical rays in the tropics is very much greater—on one day fifty-five times as great, as in our latitudes; and these measurements prove that the reported failures of photographers cannot at any rate be ascribed to a diminution in the chemical intensity of sunlight. The following numbers give some of the daily mean chemical intensities at Pará compared with the same days in Kew:—

Daily Mean Chemical Intensity.

1866.	Kew.	Pará.	Ratio.
April 6	28·6	242·0	8·46
„ 7	7·7	301·0	39·09
„ 9	5·9	326·4	55·25
„ 11	25·4	233·2	9·18
„ 20	38·9	385·0	9·90
„ 24	83·6	362·7	4·34

The measurements were made at Pará in the middle of the rainy season, and at very frequent intervals during the day; the curves show the enormous and rapid variation in intensity from hour to hour which the chemically active rays undergo under a tropical sun during the rainy season.

IX. "On the Elimination of Nitrogen during Rest and Exercise on a regulated Diet of Nitrogen." By E. A. Parkes, M.D., F.R.S. Received June 1, 1867.

The experiments recorded in this paper are intended to complete the inquiry into the effect of rest and exercise on the elimination of nitrogen recorded in the Proceedings of the Royal Society (No. 89, 1867).

The experiments were made on two soldiers at the Royal Victoria Hospital at Netley. One of them (S.) was the subject of the former experiments, the other man (B.) was a fresh man. B. is a perfectly healthy temperate man, aged 22½ years, 5 feet 9¼ inches in height, and weighing 140 lbs.

Extreme care was taken to ensure the greatest accuracy both as to food and as to the collection of the excreta. The whole value of such experiments as these, depends on the exactness with which all the conditions are carried out; and without perfect accuracy, the results would only mislead. I have every confidence that the conditions were faithfully observed; there is in fact evidence of this from the experiments themselves.

The course of the experiments was precisely the same as in the observations recorded in the last paper, except that the diet was during sixteen days exactly the same on each day. During four days the men were at their ordinary employment; during two days rested; returned to ordinary work for four days; took very active exercise for two days; and were then for four days more on ordinary occupation.

They took each day the same amount of food, viz.:—